1977

CLASS 259.02

INSTRUCTION MANUAL

CORNELL - DUBILIER

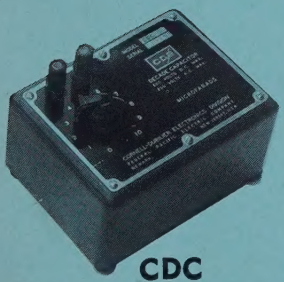
CAPACITOR DECADES

MODELS CDA - CDB - CDC - CDE - CDT - CDRM

CDA

CDB

CDT



CDC

CDE

A PRODUCT OF

CDE

CORNELL
DUBILIER
ELECTRONICS

FEDERAL PACIFIC ELECTRIC COMPANY

Fuquay-Varina, North Carolina

GUARANTEE

This DECADE CAPACITOR is guaranteed to perform as described and to be free from any defects in materials or workmanship. Any failure due to these causes will be adjusted by repair or replacement without charge if the instrument is returned prepaid to our factory within 90 days from date of purchase.

FORM BI 269—REVISION A 6/63
PRINTED IN U. S. A.
THE GRAPHIC PRESS, INC., RALEIGH, N. C.

Cornell-Dubilier

DECADE CAPACITORS

SPECIFICATIONS

MODELS CDA-2 AND CDA-5

Capacitance Range: .0001 to .011 Mfd. (in steps of .0001 Mfd.)
Voltage Rating: 600 DC — 220 AC Max.
Tolerance: CDA-2 ±2%
CDA-5 ±5%
Dielectric of Capacitors: Mica
Case Size: Depth 3 13/16" +1/32" −1/64"
Width 5" +1/32" −1/64"
Height 3 5/8" ± 1/32" (Not including rubber feet. Allow approximately 5/16" for rubber feet.)
Weight: 1 lb., 2 oz.
Parts List: See Page 15.

MODELS CDB-3 AND CDB-5

Capacitance Range: .01 to 1.1 Mfd. (in steps of .01 Mfd.)
Voltage Rating: 600 DC — 220 AC Max.
Tolerance: ±3% (CDB-3) ±5% (CDB-5)
Dielectric of Capacitors: Oil-Paper
Case Size: Depth 3 13/16" +1/32" −1/64"
Width 5" +1/32" −1/64"
Height 3 5/8" ±1/32" (Not including rubber feet. Allow approximately 5/16" for rubber feet.)
Weight: 1 lb., 6 oz.
Parts List: See Page 15.

MODELS CDC-3 AND CDC-5

Capacitance Range: 1.0 to 10.0 Mfd. (in steps of 1.0 Mfd.)
Voltage Rating: 600 DC — 220 AC Max.
Tolerance: ±3% (CDC-3) ±5% (CDC-5)
Dielectric of Capacitors: Oil-Paper
Case Size: Depth 3 13/16" +1/32" −1/64"
Width 5" +1/32" −1/64"
Height 3 5/8" ±1/32" (Not including rubber feet. Allow approximately 5/16" for rubber feet.)
Weight: 2 lbs., 8 oz.
Parts List: See Page 15.

MODEL CDRM-3—THREE-DECADE-UNIT PANEL RACK

Comprising One Each: CDA-2; CDB-3; CDC-3
Case Size: See Page 10.
Weight: 5 lbs., 8 oz.

MODEL CDE

Capacitance: 10 Mfd. to 150 Mfd. (in steps of 10 Mfd.)
Voltage Range: To 450 volts Direct Current, Maximum
Case Size: Depth 3 13/16" +1/32" −1/64"
Width: 5" +1/32" −1/64"
Height 3 5/8" ±1/32" (Not including rubber feet. Allow approximately 5/16" for rubber feet.)
Weight: 1 lb., 8 oz.
Capacitor Values: 1 - 10 Mfd., 1 - 20 Mfd., 3 - 40 Mfd.
Long life, etched cathode, low ripple, all-purpose type capacitors.
Especially suited for selenium rectifier circuit applications.

MODEL CDT

Capacitance: 10 to 1100 Mfd. (in steps of 10 Mfd.)
Voltage Rating: 50 volts DC Max. Polarized
Tolerance @ +25°C: 10-100 Mfd. Range, ±5%
100-1000 Mfd. Range, ±10%

Capacitors: Ttantalum foil electrolytics
10-100 Mfd. Range, Plain
100-100 Mfd. Range, Etched

Polarity: Capacitors and binding posts are polarized
Red—Positive: Black—Negative

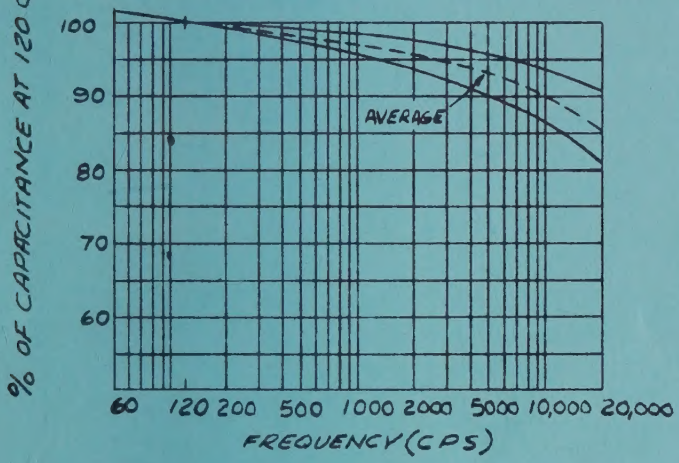
Case Size: Depth 3 13/16"
Width 5"
Height 3 11/16" (Including rubber feet and binding posts.)
Weight 1 lb., 4 oz.

Tantalum Capacitors offer definite advantages over other types of units for many applications. Where close capacitance tolerances are required, low leakage current values are important, and where low losses provide useful circuit characteristics, this type of unit offers excellent performance. This is very important where high capacitance values are required in limited space, since other capacitance types having similar characteristics require much larger volumes.

Tantalum Capacitors are very useful in low-voltage, low-impedance coupling circuits, in by-pass or de-coupling circuits, and in signal filtering complexes. However, as the **Maximum AC ripple voltage** should not exceed 1% of the DC rating (0.5 V. AC for the CDT), this type is not suitable for "smoothing filters" following rectifiers in power supplies.

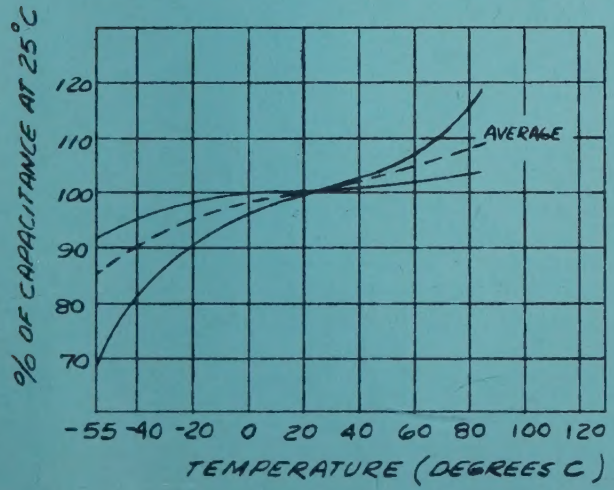
MODEL CDT

CAPACITANCE VS FREQUENCY VARIATION
GENERAL LIMITS OF CAPACITANCE CHANGE FROM 120 CPS



MODEL CDT

CAPACITANCE VS TEMPERATURE
GENERAL LIMITS OF CAPACITANCE CHANGE FROM 25°C.



GENERAL

Cornell-Dubilier Decade Capacitors provide a reliable and accurate source of precision selected capacitances for substitution purposes in a wide variety of electronic and electrical applications within the ratings of each unit.

Within the tolerance limits of each model, the selected value of capacitance may be read directly from the selector switch scales. However, where precise "on-the-nose" values are required, the exact values may be determined from the hand calibrated chart provided with each unit.

CALIBRATION

Each of the Decade Capacitors Models CDA will provide a selection of 110 precision capacitance values, in steps of .0001 Mfds. For example: if the left hand selector switch of Model CDA-5 is set .003 and the right hand selector switch at .0005, the capacitance appearing at the decade terminals will be .0035 (.003 plus .0005).

Similarly, each CDB model will also provide 110 precision capacitance values, in steps of .01 Mfds. In this case, if the left hand selector switch is set at .4 and the right hand selector switch at .06, the capacitance at the terminals will be .46 (.4 plus .06).

Models CDC provide for a selection of precision capacitance values from 1.0 to 10.0 Mfds. in steps of 1.0 Mfd. The values may be read directly from the single selector switch scale.

Model CDE provides a selection of fifteen combinations of capacitances ranging from 10 Mfd. to 150 Mfd., in steps of 10 Mfds. For example, if the 10 Mfd. and the 40 Mfd. toggle switches are in the "On" position, the capacitance at the box terminals is 50 Mfd. (10 + 40, etc.). The unit may be used individually or may be connected in parallel with other similar units to provide an unlimited range of higher capacitances.

The Model CDT Tantalum Capacitor Decade provides a reliable and accurate source of low loss, close tolerance, and high quality capacitances for circuit determination purposes in a wide variety of electronic and solid state applications within the ratings of the unit. The proper value of permanent circuit capacitance can be determined directly from the selector switch positions.

A selection of 110 precision capacitance values is provided in steps of 10 Mfd. For example: If the left hand selector switch is set at 300 and the right hand selector switch at 50, the capacitance appearing at the decade terminals will be 350 Mfd. (300 plus 50). The unit may be used individually or may be connected in parallel with other similar units to provide an unlimited range of higher capacitances.

HOW TO USE A DECADE CAPACITOR FOR "IN-THE-CIRCUIT" SUBSTITUTION

Models CDA, CDB, CDC, CDRM

(a) Select the decade whose capacitance range most nearly covers the anticipated value which will be required in the circuit.

(b) Set the Selector Switch or switches to the zero (0) position.

(c) Connect the terminals of the decade into the circuit at the point where the substitution is to be made. KEEP THE CONNECTING LEADS AS SHORT AS POSSIBLE.

(d) Now set the switch or switches to any desired capacitance or combination of capacitances until the circuit under test performs as desired. The capacitance values may be read directly from the scales, or more accurately determined from the hand calibrated chart.

(e) Upon completion of the test, remove connecting leads and DISCHARGE ALL TAPS THROUGH A 1000 OHM RESISTOR. This is accomplished by connecting the resistor to the terminal posts and rotating the selector switches throughout the entire range.

CAUTION: DO NOT SUBJECT THE INSTRUMENT TO VOLTAGES IN EXCESS OF RATED VALUES.

MAXIMUM VOLTAGES:

CDA, CDB, CDC — 600 V. DC, 220 V. AC

HOW TO USE ELECTROLYTIC CAPACITOR SUBSTITUTION BOX Model CDE and Model CDT

(1) Set all switches to "Off" or "0" position.

(2) Connect the box terminals (— and +) into the circuit at the point at which the substitution is to be made.

BE SURE THAT THE POSITIVE (+) SIDE OF THE CIRCUIT IS CONNECTED TO THE POSITIVE (+) TERMINALS OF THE SUBSTITUTION BOX AND THE NEGATIVE (—) SIDE OF THE CIRCUIT IS CONNECTED TO THE NEGATIVE (GND) TERMINAL OF THE SUBSTITUTION BOX.

(3) Now set the switch or switches to select the value of capacitance called for in the circuit or to the value of capacitance which gives the desired circuit performance.

(4) After the proper value of capacitance has been determined as in (3) above, the value of the replacement capacitor can be read directly from the toggle switches by simply adding together the values of all the switches in the "On" or numbered position.

(5) Disconnect the test leads from the circuit and immediately connect them across a 1,000 ohm resistor with all toggle switches set in the "On" position for CDE, or rotate the selector throughout entire range for CDT. This procedure will prevent accidental shock by discharging any residual voltage remaining in the capacitors and at the same time will prevent damage to any circuit in which a substitution check is subsequently made.

NOTE: For Model CDE it is a normal characteristic of electrolytic capacitors that their direct current leakage has a tendency to increase with "idle" shelf time, or if the equipment has not been in use for an extended period. This will adversely affect the efficiency of the unit.

After an extended "idle" period, however, electrolytic capacitors can be restored to **normal** leakage by a process called "ageing". "Ageing" is accomplished by applying a direct current voltage (equal to the working voltage of the unit) through a 2,000 ohm, 10-watt resistor directly to the terminals of the capacitor for a period of approximately 10 minutes. A longer or shorter period may be required, depending on the leakage condition of the capacitor.

The positive (+) terminal of the direct current voltage source must be connected to the positive (+) terminal of the capacitor and the negative (−) to the negative (−) terminal of the capacitor. The terminals of the capacitor, of course, must be disconnected from any circuit in which they may be located.

This procedure is generally effective. However, it is recommended that the capacitor be checked for leakage on a standard capacitance leakage checker before reconnecting the unit into a circuit.

CAUTION: DO NOT SUBJECT THE INSTRUMENT TO VOLTAGE IN EXCESS OF RATED VALUES.

MAXIMUM VOLTAGE:

CDE — 450 V. DC ONLY

CDT — 50 V. DC ONLY

PARALLEL CONNECTED DECADES HAVING LIKE TYPE CAPACITORS

Any combination of Capacitor Decades may be grouped in parallel to provide a wide range of accurate standards with maximum flexibility.

For example: One each of Models CDA, CDB and CDC connected in parallel will permit a selection of capacitances from 0 to 11.111 Mfds. in steps of .0001 Mfd. Precise values may be determined from the hand-calibrated charts provided with each instrument.

EXACT VALUES (PARALLEL CONNECTED DECADES)

If an exact value is required which cannot be found on the hand-calibrated chart, proceed as follows: Let us assume that an exact value of .05 Mfds. is required and that the nearest value obtainable, as indicated on the Model CDB calibrated chart, is .0484. Subtract .0484 from .05. The difference is .0016.

First, set the left-hand selector switch of the CDB to zero (0) and the right-hand selector switch to .05 Mfds. In these positions the exact capacitance value at the terminals will be .0484 Mfd.

Now, from the hand-calibrated chart on the Model CDA, select one or two values that when added together will total .0016 Mfds. (or as close to that value as possible). Set the selector switches at the corresponding scale taps.

TYPICAL EXAMPLE

EXACT VALUES (PARALLEL CONNECTED DECADES)

Model	Set Left Hand Selector at	Calibrated Value	Set Right Hand Selector at	Calibrated Value
CDB	0	0	.05	.0484
CDA	.001	.00102	.0006	.000621

Then, .00102 + .000621 + .0484 = .050041.

In like manner, other exact values of capacitance may be selected by utilizing the calibration charts attached to the bottom of each Decade Capacitor.

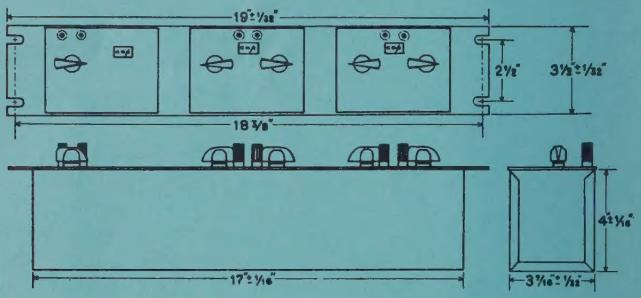
THREE-DECADE-UNIT PANEL RACK
CDRM SERIES

Model CDRM is a combination of 3 Decades panel mounted and shielded for simple installation on a conventional 19 inch rack.

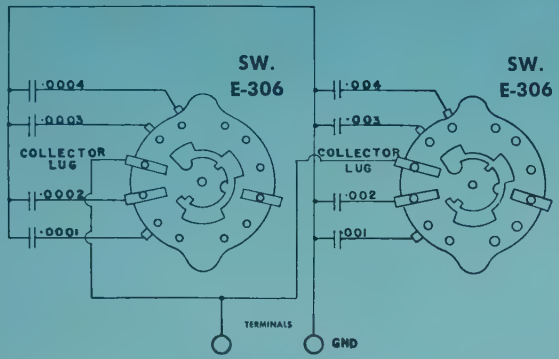
This compact and readily accessible unit provides a wide range of capacitances (or resistances) for laboratory and deluxe service shop use.

Each Decade can be used independently or connected in various combinations to supply an almost unlimited number of values.

The Decades are mounted on a rugged aluminum panel and all are completely shielded within the heavy gauge steel box.



DECADES — MODELS CDA-2, CDA-5

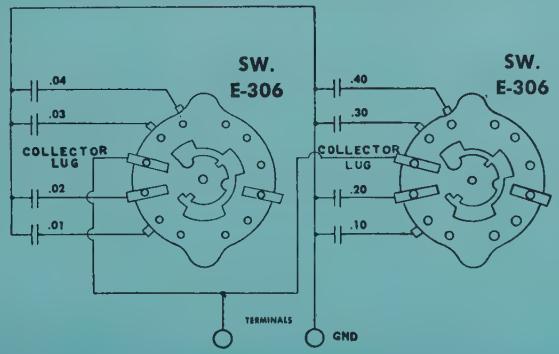


CIRCUIT DIAGRAM
(Bottom View of Switches in "O" Position)

Right Hand Switch at	Capacitor In Circuit			
.0001	.0001			
.0002	.0002			
.0003	.0001	+.0002		
.0004	.0004			
.0005	.0002	+.0003		
.0006	.0002	+.0004		
.0007	.0003	+.0004		
.0008	.0001	+.0003	+.0004	
.0009	.0002	+.0003	+.0004	
.001	.0001	+.0002	+.0003	+.0004

Left Hand Switch at	Capacitor In Circuit			
.001	.001			
.002	.002			
.003	.001	+.002		
.004	.004			
.005	.002	+.003		
.006	.002	+.004		
.007	.003	+.004		
.008	.001	+.003	+.004	
.009	.002	+.003	+.004	
.01	.001	+.002	+.003	+.004

MODEL CDB-3 AND CDB-5 DECADES

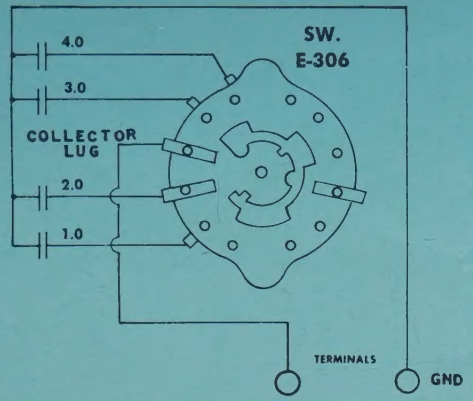


CIRCUIT DIAGRAM
(Bottom View of Switches in "O" Position)

Right Hand Switch at	Capacitor In Circuit
.01	.01
.02	.02
.03	.01 +.02
.04	.04
.05	.02 +.03
.06	.02 +.04
.07	.03 +.04
.08	.01 +.03 +.04
.09	.02 +.03 +.04
.1	.01 +.02 +.03 +.04

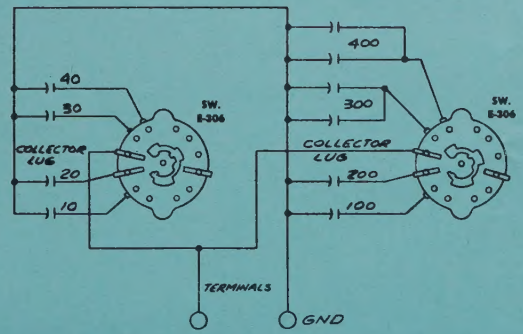
Left Hand Switch at	Capacitor In Circuit
.1	.1
.2	.2
.3	.1 +.2
.4	.4
.5	.2 +.3
.6	.2 +.4
.7	.3 +.4
.8	.1 +.3 +.4
.9	.2 +.3 +.4
1.0	.1 +.2 +.3 +.4

MODEL CDC-3 AND CDC-5 DECADES



CIRCUIT DIAGRAM
(Bottom View of Switch in "O" Position)

Switch at	Capacitor In Circuit
1	1.0
2	2.0
3	1.0 +2.0
4	4.0
5	2.0 +3.0
6	2.0 +4.0
7	3.0 +4.0
8	1.0 +3.0 +4.0
9	2.0 +3.0 +4.0
10	1.0 +2.0 +3.0 +4.0



CDT
CIRCUIT DIAGRAM
(BOTTOM VIEW OF SWITCHES IN "0" POSITION)

RIGHTHAND SWITCH AT	CAPACITOR IN CIRCUIT
10	10
20	20
30	10 + 20
40	40
50	20 + 30
60	20 + 40
70	30 + 40
80	10 + 30 + 40
90	20 + 30 + 40
100	10 + 20 + 30 + 40

LEFTHAND SWITCH AT	CAPACITOR IN CIRCUIT
100	100
200	200
300	100 + 200
400	400
500	200 + 300
600	200 + 400
700	300 + 400
800	100 + 300 + 400
900	200 + 300 + 400
1000	100 + 200 + 300 + 400

CAPACITOR DECADE MODELS
PARTS LIST

DESCRIPTION	CDA-2 2%	CDA-5 5%	CDB-3 3%	CDB-5 5%	CDC-3 3%	CDC-5 5%	CDE	CDT
CASE (Less Panel and Base Plate)	MX-92	MX-92	MX-92	MX-92	MX-92	MX-92	MX-94	MX-92
BASE PLATE	L-3357	L-3357	L-3357	L-3357	L-3357	L-3357	L-3357	L-3361
PANEL	NP-4001	NP-4001	NP-4002	NP-4002	NP-4003	NP-4003	NP-4004	NP-4009
SWITCH	E-306(2)	E-306(2)	E-306(2)	E-306(2)	E-306(1)	E-306(1)	E-319(4)	E-306(2)
BINDING POST — (Black)	S-862-0	S-862-0	S-862-0	S-862-0	S-862-0	S-862-0	S-862-0	S-862-0
BINDING POST — (Red)	S-862-2	S-862-2	S-862-2	S-862-2	S-862-2	S-862-2	S-862-2	S-862-2
KNOB	E-201(2)	E-201(2)	E-201(2)	E-201(2)	E-201(1)	E-201(1)	———	E-201(2)
RECESS BUMPERS	RP-36(4)	RP-36(4)	RP-36(4)	RP-36(4)	RP-36(4)	RP-36(4)	RP-36(2)	RP-36(4)
SCREW, SELF TAP BH. 4.40 x 5/16	SS-1883-2(8)	SS-1883-2(8)	SS-1883-2(8)	SS-1883-2(8)	SS-1883-2(8)	SS-1883-2(8)	SS-1883-2(8)	SS-1883-2(2)
SCREW, SELF TAP BH. 4.40 x 5/16 SPECIAL	———	———	———	———	———	———	———	SS-1883-8(6)
SCREW, SELF TAP BH. 6.32 x 3/8	SS-64-2(4)	SS-64-2(4)	SS-64-2(4)	SS-64-2(4)	SS-64-2(4)	SS-64-2(4)	SS-64-2(4)	SS-64-2(4)
WASHER, NICKEL SWITCH	———	———	———	———	———	———	U-1076(4)	———
CAPACITORS								
93 MMF @ 500 VDC	C-880-1	C-878-1	———	———	———	———	———	———
195 MMF @ 500 VDC	C-880-2	C-878-2	———	———	———	———	———	———
300 MMF @ 500 VDC	C-880-3	C-878-3	———	———	———	———	———	———
400 MMF @ 500 VDC	C-880-4	C-878-4	———	———	———	———	———	———
1000 MMF @ 500 VDC	C-881-1	C-877-1	———	———	———	———	———	———
2000 MMF @ 500 VDC	C-881-2	C-877-2	———	———	———	———	———	———
3000 MMF @ 500 VDC	C-881-3	C-877-3	———	———	———	———	———	———
4000 MMF @ 500 VDC	C-881-4	C-877-4	———	———	———	———	———	———
.01 MFD @ 600 VDC	———	———	C-879-1	C-890-1	———	———	———	———
.02 MFD @ 600 VDC	———	———	C-879-2	C-890-2	———	———	———	———
.03 MFD @ 600 VDC	———	———	C-879-3	C-890-3	———	———	———	———
.04 MFD @ 600 VDC	———	———	C-879-4	C-890-4	———	———	———	———
.1 MFD @ 600 VDC	———	———	C-882-1	C-891-1	———	———	———	———
.2 MFD @ 600 VDC	———	———	C-882-2	C-891-2	———	———	———	———
.3 MFD @ 600 VDC	———	———	C-882-3	C-891-3	———	———	———	———
.4 MFD @ 600 VDC	———	———	C-882-4	C-891-4	———	———	———	———
DUAL 1.0—2.0 MFD. ±3% @ 600 VDC OR 220 VAC	———	———	———	———	C-883-1	C-883-2	———	———
DUAL 3.0—4.0 MFD ±5% @ 600 VDC OR 220 VAC	———	———	———	———	C-884-1	C-884-2	———	C-909-1
10 MFD ±5% @ 50 VDC	———	———	———	———	———	———	———	C-909-2
20 MFD ±5% @ 50 VDC	———	———	———	———	———	———	———	C-909-3
30 MFD ±5% @ 50 VDC	———	———	———	———	———	———	———	C-909-4
40 MFD ±5% @ 50 VDC	———	———	———	———	———	———	———	C-909-5
100 MFD ±10% @ 50 VDC	———	———	———	———	———	———	———	C-909-6
200 MFD ±10% @ 50 VDC	———	———	———	———	———	———	———	*C-909-7
300 MFD ±10% @ 50 VDC	———	———	———	———	———	———	———	*C-909-8
400 MFD ±10% @ 50 VDC	———	———	———	———	———	———	———	———
10 MFD −10 +50% @ 450V (ELECTRO)	———	———	———	———	———	———	C-892-1	———
20 MFD −10 +50% @ 450V (ELECTRO)	———	———	———	———	———	———	C-892-2	———
40 MFD −10 +50% @ 450V (ELECTRO)	———	———	———	———	———	———	C-892-3(3)	———

NOTE: Numerals in parenthesis indicate quantity per unit.

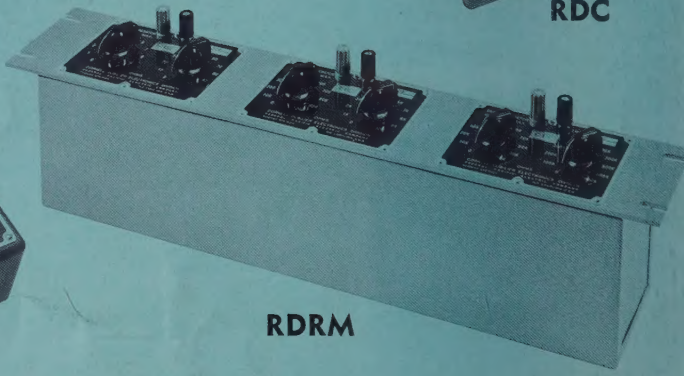
*Made up of matched pairs (C-909-7 (1) each C-909-5 & C-909-6. (C-909-8) (2) C-909-6.

RESISTOR DECADES

by CDE

RDA

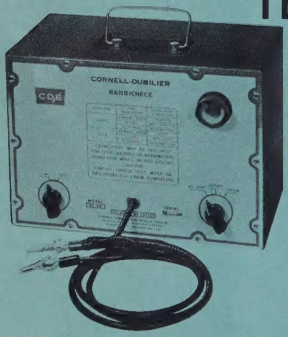
RDC



RDRM

RDB

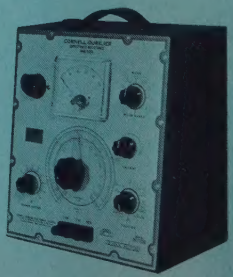
TEST INSTRUMENTS



"Handicheck" Capacitor Checker — BF-90

Capacitance - Resistance Bridge — BF-60

Flyback and Yoke Checker — BF-80



Capacitor - Resistor Analyzer — BF-71